PREPRODUCTION INITIATIVE-NELP
AIR-ASSISTED AIRLESS PAINT SPRAY SYSTEM
AND LASER TOUCH PAINTING GUIDES
FINAL REPORT

NADEP Paint Shop, Naval Air Station North Island
SIMA, Naval Station Mayport

1.0 INTRODUCTION

The U.S. Navy has adopted a proactive and progressive position toward protecting the environment and complying with environmental laws and regulations. Rather than merely controlling and treating hazardous waste by end-of-the-pipe measures, the Navy has instituted a program for pollution prevention (P2) to reduce or eliminate the volume and toxicity of waste, air emissions, and effluent discharges.

P2 allows the Navy to meet or exceed current and future regulatory mandates and to achieve Navy-established goals for reducing hazardous waste generation and toxic chemical usage. P2 measures are implemented in a manner that maintains or enhances Navy readiness. Additional benefits include increased operational efficiency, reduced costs, and increased worker safety.

The Navy has truly set the standard for the procurement and implementation of P2 equipment. The Chief of Naval Operations (CNO), Environmental Protection, Safety, and Occupational Health Division (N45) established the P2 Equipment Program (PPEP), through which both the Naval Air Warfare Center Aircraft Division Lakehurst (NAWCADLKE) and the Naval Facilities Engineering Service Center (NFESC) serve as procurement agents under the direction of N45. P2 equipment is specified and procured under two complementary initiatives: the Preproduction Initiative (i.e., technology demonstration) and the Competitive Procurement Initiative. The Preproduction Initiative directly supports both the Navy Environmental Leadership Program (NELP) for P2 shore applications and the P2 Afloat program, which prototypes and procures P2 equipment specific to the needs of ships.

This report provides an analysis of the procurement, installation, and operation of P2 equipment under the Preproduction Initiative. Technology demonstrations and evaluations are primarily performed under NELP at two designated Preproduction sites—Naval Air Station North Island (NASNI) and Naval Station (NS) Mayport. Additional sites have been added as required to meet specific mission goals. The program involves defining requirements, performing site surveys, procuring and installing equipment, training operators, and collecting data during an operational test period. The equipment is assessed for environmental benefits, labor and cost savings, and its ability to interface with site operations.

2.0 BACKGROUND

The Naval Depot (NADEP) Paint Shop located at NASNI paints F/A-18, S-3, and C-2 components and airframes. The Shipboard Intermediate Maintenance Activity (SIMA) Fire Control Shop (Shop 67E) at NS Mayport paints radar domes (radomes) and antennas, among other shipboard items.

2.1 Current U.S. Navy Painting Practices

The NADEP Paint Shop currently coats aircraft components and airframes with liquid paints using high-volume, low-pressure (HVLP) paint guns. HVLP paint guns use a larger volume of air at a lower pressure than conventional systems to coat components. The Paint Shop uses a waterborne primer that meets military specification (MIL-SPEC) MIL-P-85582. Several colors of two-component, solvent-based topcoats are used at the Paint Shop, and all meet MIL-SPEC MIL-C-85285B.

The SIMA uses the following paints:

- Devethane 378 White Tint Base, 378B9500
- Devethane 379 White Base, 379B3501
- Devthane 379 High Solids Gloss, 379C0910
- Devthane 378 Convtr, 378C0910

The transfer efficiency of paint guns is the ratio of the volume of paint that adheres to the surface being coated to the volume of paint that was sprayed, expressed as a percentage. The transfer efficiency of the HVLP paint guns currently used at the Paint Shop averages approximately 75% for large surfaces, 60% for medium-sized surfaces, and 40% for small surfaces. Assuming that the Paint Shop coats 80% large surfaces, 15% medium surfaces, and 5% small surfaces, the overall average transfer efficiency for current operations is 71%. At the SIMA, approximately 15% of the coating is performed on large surfaces; the remainder is on small surfaces. Based on these figures, the average transfer efficiency for current operations using HVLP equipment is approximately 45%.

2.2 System Selection

In view of the Navy's P2 goals, a system was sought to improve the transfer efficiency of paint operations at the NADEP Paint Shop and at the SIMA. Improvement in the transfer efficiency will result in a reduction of the volume of paint needed, thus reducing procurement costs. In addition, the improvement in transfer efficiency will result in a reduction in the volume of waste generated by reducing overspray. Therefore, the selected system must be capable of meeting or improving upon the transfer efficiency provided by the HVLP spray guns currently in use.

3.0 EQUIPMENT DESCRIPTION

3.1 Vendor Selection

Air-assisted airless paint systems have been shown to have average transfer efficiencies of 95% for large surfaces, 85% for medium surfaces, and 78% for small surfaces. Using the same percentages based on the size of the parts coated at the Paint Shop (provided above), the overall transfer efficiency of an air-assisted airless paint system was expected to be approximately 93%. Looking at the same percentages for the size of the parts coated at the SIMA (described above), the overall transfer efficiency of an air-assisted airless paint system was expected to be approximately 81%.

Extensive vendor searches were conducted for an air-assisted airless paint spray system for testing at the NADEP Paint Shop. Based on the results of this search, the Kremlin Airmix spray system was selected for the demonstration effort. This decision was made based both on price and on the fact that the vendor was able to provide the results of independent tests demonstrating transfer efficiencies greater than the HVLP systems currently in use at the site.

In addition to evaluating the effectiveness of the Kremlin Airmix spray system, this project evaluated a laser sighting system that provides painters with immediate feedback on the distance of the spray gun from and the angle of the gun with respect to the part being painted. The laser sighting system would help to ensure that paint is applied to the part at an even thickness, thus preventing "zebra striping" and improving the quality of the coating. An extensive vendor search was also conducted for manufacturers of a laser sighting system for use with paint guns. Only one vendor, Laser Touch and Technologies, LLC of Cedar Falls, Iowa, was identified.

3.2 System Components

3.2.1 AirMix Air-Assisted Airless Paint System

The AirMix system demonstrated for this project includes, but is not limited to, the following components:

- Two AirMix MX-LT paint guns with BX16, 06-116 aircaps and tips
- Two AirMix 20.25 pump system
- Associated hardware (e.g., manifold, fluid and air hoses, etc.).

Two AirMix systems (i.e., four paint guns, two pumps) were implemented at the NADEP Paint Shop.

3.2.2 Laser Touch Laser Sighting System

The Laser Touch laser sighting system demonstrated for this project includes, but is not limited to, the following components:

- 4 LT-B512 targeting tools
- 4 universal brackets
- 1 training spray gun.

Each LT-B512 targeting tool is attached to an AirMix paint gun by means of the universal bracket.

3.3 Method of Operation

3.3.1 AirMix Air-Assisted Airless Paint System

Conventional and HVLP paint systems typically use pneumatic pressure to force paint from the pump through the spray gun. Additional air is then injected into the paint stream to disperse the paint into a fan of droplets. The AirMix air-assisted airless system uses a pneumatic pump to create hydraulic pressure that forces the paint through a small orifice on the tip of the paint gun. As the paint moves through the orifice, it disperses into a fan of paint droplets that move at a lower fluid velocity than HVLP systems. A small amount of air is then injected into the fan of paint, causing the fan to disperse into smaller droplets that are evenly distributed throughout the fan.

Conventional systems typically consume between 5 and 14 cubic feet per minute (cfm) of air and project paint at speeds of approximately 30 feet per second. HVLP systems typically consume between 15 and 30 cfm of air and project paint at a speed of approximately 21 feet per second. Air-assisted airless systems typically consume between 2 and 3 cfm of air and project paint at speeds of approximately 2 to 3 feet per second.

3.3.2 Laser Touch Laser Sighting System

The laser sighting system demonstrated for this project is mounted on the spray gun via the universal bracket supplied with the laser. The laser system projects two laser beams that can be set to converge at a specified distance. Therefore, if the gun is at the appropriate distance and is square to the component being coated, a single image appears on the component. If the gun is not the appropriate distance from the component or if the gun is not squarely facing the component, two images will appear. Thus, the painter can immediately make corrections to the distance and angle between the gun and the component.

In addition, by keeping the laser image even with the wet edge of the prior pass, the system ensures that each pass provides a consistent 50% overlap with the prior pass. This prevents “zebra striping,” whereby uneven volumes of paint are applied to sections of the component.

The laser projectors are protected from paint overspray by “Visor Raps,” which are clear, disposable plastic parts that fit over the laser projectors.

3.4 Implementation Requirements

3.4.1 AirMix Air-Assisted Airless Paint System

Each AirMix air-assisted airless paint system demonstrated for this project consisted of two spray guns, one pump, one cart, and associated hardware. The specifications and requirements (as supplied by the manufacturer) for the AirMix air-assisted airless paint system include:

Spray Gun
- Model: AirMix MX LT
- Aircap and Tip: BX16, 06-116
- Weight: 1.25 lb.
- Supply Air Pressure: 5 to 15 psi
- Air Consumption: 2 to 3 cfm
- Construction: Stainless steel
- Trigger: 2-step ergonomic with lock

Pump and Cart
- Pump Model: AirMix 20.25
- Cart Dimensions (height x depth x width): 36” x 22” x 18”
- Total Weight: 45 lb.
- Supply Air Pressure: 30-60 psi
- Air Consumption: 16 cfm

Associated Hardware
- Filter assembly
- 2-gun manifold
- 50-ft. fluid supply hose
- 50-ft. air supply hose

3.4.2 Laser Touch Laser Sighting System

The specifications and requirements (supplied by the manufacturer) for the Laser Touch laser sighting system include:

- Laser Class: IIIA
- Dimensions (length x depth x width): 4.5” x 0.75” x 1.75”
- Weight: 6.5 oz.
- Power Supply: 2 AA batteries
- Laser Intensity: 0.93 milliWatts
- Wavelength: 650 nanometers

3.5 Overall Benefits

The improved transfer efficiency provided by the air-assisted airless paint system has several potential benefits, including:

- Reduces paint procurement costs.
- Reduces waste disposal costs.
- Reduces labor costs.

The laser sighting system provides several potential benefits, including:

- Improves finish coat.
- Reduces waste disposal costs.
- Reduces labor costs

4.0 PROJECT HISTORY AND QUALITATIVE ANALYSIS

4.1 Project History

The spray system was initially provided to the NADEP Paint Shop. Site personnel were trained by the manufacturer's representative; however, the site immediately encountered problems using the equipment. NADEP Paint Shop personnel indicated that paint was leaking from the tip of the gun. The manufacturer recommended corrective action, including tightening the aircap, confirming the presence of a washer in the tip, cleaning the aircap, and adjusting the pressure to approximately 400 psi. These recommendations seemed to resolve the problem.

The site also requested a wider tip so that they could cover a greater area during a pass. The wider tips were provided. However, in order to change the fan adjustment, the Kremlin design required that the tip be physically changed out. The site also encountered problems with the gun clogging. Due to limitations on the quantity of volatile organic compounds (VOCs) that may be used in NADEP painting processes, additional paint thinning was not a viable option.

NADEP Paint Shop personnel thought that the Laser Touch system would be useful for training beginning painters since the feedback provided by the system was not needed by experienced painters. Based on this, the air-assisted airless (AAA) spray system and Laser Touch were offered to other sites for testing purposes. The SIMA at NS Mayport expressed an interest in trying the spray system.

The manufacturer's representative trained the personnel at the SIMA Fire Control Shop in the use of the spray system. During this training, it was found that the painters needed to increase the speed of each pass when using the AAA spray system as opposed to the Binks HVLP spray guns. If the painter did not move the gun across the piece with sufficient speed, too much paint was applied and the piece would require rework. In addition, site personnel commented that since the AAA spray system can provide a thick enough coat in a single pass, only one coat of paint would be required instead of the two needed with the current process.

After additional use, SIMA Fire Control Shop personnel provided the following comments regarding the AAA spray system:

- The system reduced overspray compared to the HVLP guns. This resulted in a cleaner work environment, which reduced cleanup time.
- It was easier to coat large smooth surfaces with the AAA system than with the HVLP guns.
- The AAA system was not able to apply even coatings to the angles of radomes, resulting in additional rework.
- The AAA system provides painters less control over the volume of paint applied than the HVLP system due to the shape of the dispersing nozzles used.
- The AAA system has a longer hose and deeper suction device than the current HVLP system used at the site. This results in a greater volume of paint that must be mixed each time the AAA system is used and generates more waste than the current system when coating small radomes.

While PPEP was exploring methods of addressing these concerns (e.g., obtaining differently shaped dispersing nozzles, obtaining shorter hose lengths for the new site, etc.), the SIMA Fire Control Shop certification to coat radomes expired. Due to the cost associated with obtaining and maintaining this certification, SIMA personnel determined that the best operating procedure would be to send the radomes to Norfolk for coating. Due to this change in site procedures, the Preproduction project was ended.

4.2 Qualitative Analysis

4.2.1 Installation

No physical modifications to the sites were required to implement the AAA spray system. However, painters did need to modify their technique to account for the increased volume of paint applied per pass.

4.2.2 Training

A ½ day of training was provided by the vendor for each site's personnel. Training covered application technique, operational settings and adjustment, and cleaning and maintenance.

4.2.3 Maintainability and Repairs

The AAA system spray guns clogged during use at the NADEP Paint Shop. In addition, personnel at the SIMA Fire Control Shop failed to sufficiently clean the guns, resulting in paint curing within them. The manufacturer's representative repaired the guns and returned them to the site.

4.2.4 Interface With Site Operations

The AAA system did not successfully interface with site operations. Painters had difficulty adjusting the speed of their movement to achieve an acceptable finish coat. In addition, painters found changing the tip to adjust the fan size to be a burden. It should be noted that the manufacturer has modified the tips so that the fan size is adjustable without changing tips. The new tips were not tested at either site because the project was cancelled (as discussed in Section 4.1 above) before they could be procured.

The SIMA Fire Control Shop painters indicated that due to the length of the hoses and the pump volume (both procured to meet NADEP Paint Shop requirements), the AAA system generates more waste than the current HVLP system used at the site when painting small items.

Neither site had a large cohort of young painters; therefore, neither site found much use for the Laser Touch system.

4.2.5 Overall Performance

Overall, personnel at both sites were dissatisfied with the AAA spray system. Site personnel indicated that the Laser Touch system was appropriate for training new painters; however, it was not needed by experienced painters.

4.2.6 Future Uses

It is unlikely that the AAA system tested for this project will be implemented at other locations. New versions of the AAA system may prove successful in a Navy operating environment provided that the equipment procured is tailored specifically to match site-specific procedures and concerns.

The Laser Touch system may be used by sites that train large numbers of painters.

4.3 Project Costs

The following table presents equipment costs incurred during the implementation of this project. It should be noted that each AirMix pump is sold with a single AirMix paint gun and 25 feet each of fluid and air hoses. Therefore, in order to meet the site's requirements for two systems consisting of 2 guns, 1 pump, and 50 feet of hoses each, it was only necessary to purchase 2 pumps, 2 additional guns, and 3 sets of 50-foot fluid and air hoses. Since two pumps were purchased, the vendor simply combined the two 25-foot lengths of fluid and air hoses into one 50-foot length.

Item	Quantity	Unit Cost	Extended Cost
Air-Assisted Airless Spray System			
AirMix MX LT Paint Gun	2	$600.00	$1,200.00
AirMix 20.25 Pump System (includes 1 AirMix MX LT Paint Gun, 50’ fluid and air hoses, and cart)	2	$2,970.00	5,490.00
Pump Filter Assembly	2	$36.21	72.42
Screen Assembly for Siphon Hose	2	$21.95	43.90
Manifold	2	$132.00	264.00
Replacement BX16, 06-116 Aircap and Tip	4	$68.00	272.00
Package of 5 Replacement Gun Screens	1	$22.95	22.95
Replacement Seals	4	$50.50	202.00
50’ Fluid Hose	3	$80.95	242.85
50’ Air Hose	3	$44.00	132.00
10 Cleaning Needles for Tip 000-094-000	1	$27.50	27.50
12 Cleaning Needles for Tip 0001-094-002	1	$27.50	27.50
AirMix Tip #12-136	6	$68.00	408.00
AirMix Tip #12-096, BX/JBX16	5	$68.00	340.00
Aircap, BX16, with Ring, JX/ATX/MX	4	$95.00	380.00
Gun Repair Kit	4	$28.05	112.20
Delrin Seats	4	$7.00	38.00
Tip Seal	1	$23.50	23.50
Filter Screen	1	$24.50	24.50
50’ Fluid Hose	1	$84.00	84.00
Labor for Pump Repair	1	$42.00	42.00
Labor for Gun Repair	1	$120.00	120.00
Needle Cartridges	4	$83.20	332.80
Air-Assisted Airless Spray System Subtotal			$10,384.62
Laser Sighting System			
Laser Touch Targeting Tool (LT-B512)	4	$639.00	$2,556.00
Universal Bracket	4	$25.00	100.00
Package of 12 Visor-Raps	2	$21.00	42.00
Training Spray Gun	1	$695.00	695.00
Laser Sighting System Subtotal			$3,393.00
		Total Equipment Cost	$11,827.62

Training for the NADEP Paint Shop was provided at a cost of $250. Training for the SIMA Fire Control Shop was provided at no additional charge. Shipping for the air-assisted airless spray system cost $149.25. Shipping for the laser sighting system cost $60.00.

5.0 LESSONS LEARNED

When specifying painting equipment, great care must be taken to ensure that the equipment is properly sized and equipped to match current site operations. In addition, appropriate training and site procedures must be implemented to ensure that paint equipment is properly cleaned after each use to prevent expensive repair costs.

6.0 CONCLUSIONS

The AAA paint spray system tested by this project did not successfully interface with the Navy operating environment. In particular, users commented that the volume of paint the spray system provided was difficult to control and that adjustments were not easily made.

The Laser Touch Sighting System may be useful as a training tool for new painters; however, based on operator comments, experienced painters are unlikely to need the reinforcement the system provides.